1. Perform the division below. Then, find the intervals that correspond to the quotient in the form $ax^2 + bx + c$ and remainder r.

$$\frac{9x^3 + 21x^2 - 7}{x + 2}$$

A. $a \in [8, 17], b \in [36, 48], c \in [77, 84]$, and $r \in [149, 151]$.

B. $a \in [8, 17], b \in [-8, -2], c \in [13, 21]$, and $r \in [-65, -60]$.

C. $a \in [-18, -14], b \in [54, 60], c \in [-114, -113]$, and $r \in [219, 224]$.

D. $a \in [8, 17], b \in [3, 8], c \in [-11, -3]$, and $r \in [4, 14]$.

E. $a \in [-18, -14], b \in [-17, -10], c \in [-32, -25]$, and $r \in [-69, -66]$.

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2. What are the *possible Rational* roots of the polynomial below?

$$f(x) = 4x^4 + 6x^3 + 3x^2 + 7x + 2$$

A. All combinations of: $\dfrac{\pm 1, \pm 2, \pm 4}{\pm 1, \pm 2}$

B. All combinations of: $\dfrac{\pm 1, \pm 2}{\pm 1, \pm 2, \pm 4}$

C. $\pm 1, \pm 2, \pm 4$

D. $\pm 1, \pm 2$

E. There is no formula or theorem that tells us all possible Rational roots.

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3. Perform the division below. Then, find the intervals that correspond to the quotient in the form $ax^2 + bx + c$ and remainder r.

$$\frac{20x^3 - 48x^2 - 116x - 43}{x - 4}$$

A. $a \in [19, 24],\ b \in [12, 13],\ c \in [-85, -79]$, and $r \in [-284, -280]$.

B. $a \in [19, 24],\ b \in [-131, -125],\ c \in [391, 398]$, and $r \in [-1632, -1622]$.

C. $a \in [19, 24],\ b \in [31, 38],\ c \in [8, 19]$, and $r \in [2, 9]$.

D. $a \in [80, 86]$, $b \in [-370, -364]$, $c \in [1356, 1360]$, and $r \in [-5472, -5466]$.

E. $a \in [80, 86]$, $b \in [269, 275]$, $c \in [969, 975]$, and $r \in [3842, 3846]$.

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4. Factor the polynomial below completely, knowing that $x + 5$ is a factor. Then, choose the intervals the zeros of the polynomial belong to, where $z_1 \leq z_2 \leq z_3 \leq z_4$. *To make the problem easier, all zeros are between -5 and 5.*

$$f(x) = 25x^4 + 210x^3 + 507x^2 + 434x + 120$$

A. $z_1 \in [1.24, 1.46]$, $z_2 \in [1.6, 1.94]$, $z_3 \in [1.3, 2.2]$, and $z_4 \in [4.71, 5.09]$

B. $z_1 \in [0.1, 0.33]$, $z_2 \in [1.89, 2.8]$, $z_3 \in [2.8, 4.5]$, and $z_4 \in [4.71, 5.09]$

C. $z_1 \in [-5.19, -4.79]$, $z_2 \in [-2.35, -1.49]$, $z_3 \in [-2, -1]$, and $z_4 \in [-1.56, -1.17]$

D. $z_1 \in [-5.19, -4.79]$, $z_2 \in [-2.35, -1.49]$, $z_3 \in [-1.1, 1.6]$, and $z_4 \in [-0.93, 0.31]$

E. $z_1 \in [0.5, 0.72]$, $z_2 \in [-0.1, 0.82]$, $z_3 \in [1.3, 2.2]$, and $z_4 \in [4.71, 5.09]$

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5. Factor the polynomial below completely. Then, choose the intervals the zeros of the polynomial belong to, where $z_1 \leq z_2 \leq z_3$. *To make the problem easier, all zeros are between -5 and 5.*

$$f(x) = 6x^3 + 5x^2 - 22x - 24$$

A. $z_1 \in [-1.67, -1.39]$, $z_2 \in [-1.42, -1.18]$, and $z_3 \in [1.7, 2.6]$

B. $z_1 \in [-2.13, -1.96]$, $z_2 \in [0.46, 0.55]$, and $z_3 \in [3.7, 4.4]$

C. $z_1 \in [-2.13, -1.96]$, $z_2 \in [0.62, 0.81]$, and $z_3 \in [-0.5, 1.2]$

D. $z_1 \in [-2.13, -1.96]$, $z_2 \in [1.22, 1.4]$, and $z_3 \in [1, 1.9]$

E. $z_1 \in [-1.04, -0.67]$, $z_2 \in [-0.83, -0.6]$, and $z_3 \in [1.7, 2.6]$

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6. Factor the polynomial below completely, knowing that $x - 4$ is a factor. Then, choose the intervals the zeros of the polynomial belong to, where

$z_1 \leq z_2 \leq z_3 \leq z_4$. *To make the problem easier, all zeros are between -5 and 5.*

$$f(x) = 12x^4 - 53x^3 - 23x^2 + 202x - 120$$

A. $z_1 \in [-3.4, -1.4]$, $z_2 \in [0.68, 0.95], z_3 \in [1.54, 1.71]$, and $z_4 \in [4, 6]$

B. $z_1 \in [-3.4, -1.4]$, $z_2 \in [0.52, 0.7], z_3 \in [1.2, 1.38]$, and $z_4 \in [4, 6]$

C. $z_1 \in [-5.6, -4.6]$, $z_2 \in [-4.05, -3.87], z_3 \in [-0.43, -0.2]$, and $z_4 \in [0, 3]$

D. $z_1 \in [-4.7, -3.1]$, $z_2 \in [-1.44, -1.16], z_3 \in [-0.71, -0.32]$, and $z_4 \in [0, 3]$

E. $z_1 \in [-4.7, -3.1]$, $z_2 \in [-1.75, -1.65], z_3 \in [-0.85, -0.62]$, and $z_4 \in [0, 3]$

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7. Perform the division below. Then, find the intervals that correspond to the quotient in the form $ax^2 + bx + c$ and remainder r.

$$\frac{8x^3 + 28x^2 - 33}{x + 3}$$

A. $a \in [5, 12], b \in [4, 6], c \in [-13, -3]$, and $r \in [0, 8]$.

B. $a \in [5, 12], b \in [52, 57], c \in [156, 158]$, and $r \in [435, 437]$.

C. $a \in [5, 12], b \in [-6, 1], c \in [13, 19]$, and $r \in [-104, -92]$.

D. $a \in [-24, -23], b \in [97, 102], c \in [-300, -290]$, and $r \in [864, 875]$.

E. $a \in [-24, -23], b \in [-48, -40], c \in [-135, -124]$, and $r \in [-432, -427]$.

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8. Factor the polynomial below completely. Then, choose the intervals the zeros of the polynomial belong to, where $z_1 \leq z_2 \leq z_3$. *To make the problem easier, all zeros are between -5 and 5.*

$$f(x) = 10x^3 - 41x^2 - 54x + 45$$

A. $z_1 \in [-6, -4.8]$, $z_2 \in [-0.8, -0.3]$, and $z_3 \in [1, 1.6]$

B. $z_1 \in [-6, -4.8]$, $z_2 \in [-3.3, -2.7]$, and $z_3 \in [-0.7, 0.6]$

C. $z_1 \in [-6, -4.8]$, $z_2 \in [-2.9, -1.5]$, and $z_3 \in [0.6, 0.9]$

D. $z_1 \in [-1, -0.1]$, $z_2 \in [0.8, 2.1]$, and $z_3 \in [4.4, 5.9]$

E. $z_1 \in [-1.9, -1.1]$, $z_2 \in [-0.1, 1.2]$, and $z_3 \in [4.4, 5.9]$

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9. Perform the division below. Then, find the intervals that correspond to the quotient in the form $ax^2 + bx + c$ and remainder r.

$$\frac{12x^3 + 45x^2 - 21x - 39}{x + 4}$$

A. $a \in [8, 13]$, $b \in [90, 102]$, $c \in [342, 359]$, and $r \in [1363, 1367]$.

B. $a \in [-49, -44]$, $b \in [-152, -144]$, $c \in [-611, -607]$, and $r \in [-2475, -2471]$.

C. $a \in [-49, -44]$, $b \in [232, 242]$, $c \in [-970, -961]$, and $r \in [3834, 3839]$.

D. $a \in [8, 13]$, $b \in [-16, -10]$, $c \in [53, 55]$, and $r \in [-310, -305]$.

E. $a \in [8, 13]$, $b \in [-3, 4]$, $c \in [-19, -8]$, and $r \in [-5, 4]$.

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10. What are the *possible Rational* roots of the polynomial below?

$$f(x) = 3x^2 + 6x + 5$$

A. All combinations of: $\dfrac{\pm 1, \pm 3}{\pm 1, \pm 5}$

B. All combinations of: $\dfrac{\pm 1, \pm 5}{\pm 1, \pm 3}$

C. $\pm 1, \pm 5$

D. $\pm 1, \pm 3$

E. There is no formula or theorem that tells us all possible Rational roots.
